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THE SAN JOSE SCALE

(Aspidiotus perniciosus Comst)

BY H. R. PAINTER
ASSISTANT ENTOMOLOGIST

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BY H. R. PAINTER
Assistant Entomologist

IMPORTANCE OF SAN JOSE SCALE AND FOOD PLANTS

The extensive methods of combating the San Jose scale as well as the vast amount of legislation that has been done throughout the United States regarding the insect should convince one of its importance. Probably no other insect has received as much attention as a horticutlural pest as the San Jose scale. It is similar in color to the bark of trees. On this account it is not very conspicuous. If a slight infestation is not checked the scale will soon increase to enormous numbers. The main host plants of this pest are peach, pear, plum, apple, currents and quince, while many other trees as well as some shrubs and vines are attacked to some extent.

HISTORY

Native Home of Scale and Introduction to Oklahoma

The native home of the pest under consideration is in China. On this account it is often called the "Chinese scale". It was first ob-

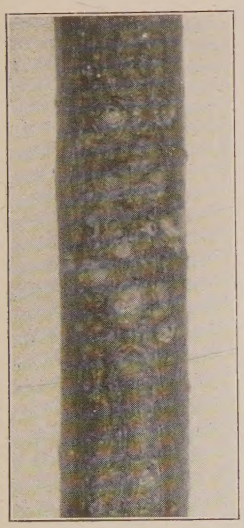

Figure 1

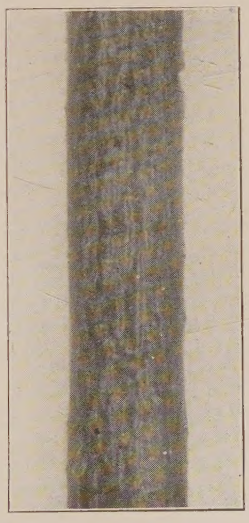

Figure 2

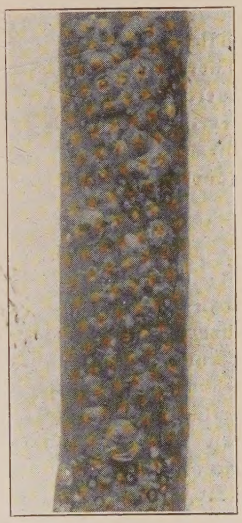

Figure 3

Figure 1.—Peach twig with slight infestation. Enlarged four times.
Figure 2.—Peach twig non-infested. Enlarged four times.
Figure 3.—Peach twig with heavy infestation. Enlarged four times.

served as a new pest in this country in the San Jose valley in California in 1870, consequently the name "San Jose" was applied to it. Twenty-three years after its appearance in California, infested stock was discovered in Virginia. This infestation was supposed to have been due to infested nursery stock received from New Jersey, which in turn had received infested stock a few years before from California. Infested stock was sent out from the New Jersey nurseries for a number of years, and the scale became well scattered throughout the United States. The first authentic record of the discovery of scale in Oklahoma was on a Japan plum tree at Mulhall, March 29, 1904.

DESCRIPTION

The adult female located beneath the scale, which is circular in outline, is about one-sixteenth of an inch in diameter, possesses neither eyes, antennae or feelers, legs nor wings, and is of a yellowish color. There is no distinct head. The only appendage that the mature female possesses is a slender tube-like organ attached near the center of the under surface of the body. By means of this organ she obtains food by inserting it into the tissue of plants and sucking sap therefrom. This particular species is distinguished from others by certain characteristics in the tip of the abdomen of the female. Each individual is concealed under a layer of thin, waxy material secreted by the insect. This protective covering is of a light gray color and possesses a small but distinct prominence at the center.

The adult male scale insect is altogether different from the female. The male possesses a distinct head, with eyes and antennae. There are also six well developed legs and a pair of wings. No mouth parts, however, are present. In general appearance the adult male resembles a small fly. Th scale covering is generally blackish during the early larval or young stage. The little pellicle or prominence is generally near the margin of the scale covering.

LIFE HISTORY

The insects pass the winter as immature forms underneath the scale covering. When plant growth begins the following spring the insects become active and obtain nourishment by sucking sap from plants to which they may be attached. About May 1st naturity is reached and the males emerge from their scales and fertilize the females. The latter soon begin to give birth to living young at a rapid rate. It has been estimated by the United States Bureau of Entomology that the total progeny of a single female would number 3,216,080,400 during a single season if all were to survive. The young crawl about on the plants during the first twenty-four to thirty-six hours of their life seeking a place to attach themselves. At this stage the sexes are similar. A mass of white, waxy filaments is soon secreted on top of the body of the young. Soon after the insect at-

aches itself to the plant the filaments become fused, forming the scale covering. Attachment may occur on the trunk, limbs, foliage or fruit. Soon after becoming fixed, the insects molt or shed their skin. Molting takes place a number of times. The cast skins form the little pellicle or prominence previously mentioned. The male matures in about twenty-four to twenty-six days and comes out from under the scale covering as a tiny, two-winged insect. The female reaches maturity in about thirty days, but does not change in form and does not emerge from the scale covering. Shortly after emerging the males fertilize the females and die. Three or four days after fertilization the females begin to give birth to living young. Reproduction continues for a period of six weeks, after which time the females die. About four hundred young are produced by a single female. The insects have been known to be active in Oklahoma as late as November.

MEANS OF DISTRIBUTION

One of the chief agencies which results in the spread of San Jose scale is infested nursery stock. No doubt scale has been transported farther in this manner than by any other means. On account of this fact, stringent laws have been enacted relative to stock so infested. (See Senate Bill No. 342, Oklahoma Session Laws, 1914-15.) It is quite possible for scale to be scattered by the sale of infested fruit.

Birds and various insects carry scale from place to place. This applies while the young insects are crawling about in search of a place to attach themselves to plants. The young may crawl upon the legs of birds and be carried quite a distance, the latter depending upon the nature of the bird. A number of young scale insects have been seen on the bodies of beetles. Some beetles feed upon scale insects, but are also responsible for scattering them to some extent. Aside from beetles, various other insects, such as grasshoppers and ants, may be instrumental in spreading the scale by carrying the young to new quarters.

Non-infested trees that are so close to infested trees as to allow the branches to intermingle may become infested while the young are actively crawling about. Such may be the case along creeks where little attention is given to horticultural interests. Trees taken from such places and transplanted in lawns, parks, etc., may be the cause of serious damage.

Wind as well as water may transport scale to distant places. It has been observed in certain instances that infestations in orchards have spread from infested twigs or leaves in the line of the prevailing winds. During a severe storm infested twigs or leaves may be detached from trees and carried to streams and thus reach a non-infested locality.

Still another factor worthy of consideration is stirring the soil around trees. During cultivation the animals, tools or man may be

instrumental in carrying young scales or bits of infested material from place to place.

METHODS OF CONTROL

Spraying.—The most efficient method of combating San Jose scale is to spray infested trees with lime-sulphur solution. The proper time to apply it is during the winter. Lime-sulphur can be purchased from insecticide dealers, or it can be prepared near the orchard. The commercial form is a concentrated solution and should be diluted with water at the rate of about one part to eight or ten parts of water. Formula and directions for preparing the solution are as follows:

Sulphur	1 lb.
Lime, unslaked	½ lb.
Water	½ gal.

Add enough water to the sulphur to make a good paste. Slake the lime in a sufficient quantity of water. Mix the solutions together and boil about gorty-five minutes, adding water at times to prevent the solution either from becoming too dry or from boiling over. When the yellow color of the sulphur disappears, boiling is finished. This mixture is called the stock solution, and it should be diluted with ten parts of water before it is applied as a spray.

Spraying should follow pruning, in case there is pruning to do. Also remove the soil to a depth of two or three inches from the crown of the tree. Spray thoroughly; that is, cover all parts of the tree with the solution. High pressure (150 pounds or more per square inch) and a good nozzle will insure a good spray. Begin at the top of the tree and spray down, treating one side of the tree at a time. The solution will not injure trees of any age if applied during the dormant season.

Dipping.—Lime-sulphur is sometimes used as a dipping solution. This method of treatment is quite satisfactory in cases where the trees are to be transplanted and are not so large as to make the handling of same inconvenient. The process consists simply in immersing the trees, except the roots, in the solution advised for spraying.

Fumigation.—Nursery stock is sometimes treated for scale by fumigation with hydrocyanic acid gas. This gas is a deadly poison, consequently the operation should receive careful attention. Fumigation may be done either in an airtight room or in a large, tight box, depending upon the amount of stock to be treated. The fumigatorium should be so arranged as to enable one to ventilate from the outside. The trees should be dry. No surplus dirt should be left on the roots. If there is any foliage on the trees it should be removed.

To obtain best results, high grade chemicals must be used. The

potassium cyanide should be 98% pure. The sulphuric acid should be good commercial grade with a specific gravity of 1.83.

The ratio of chemicals used is one part cyanide, two parts acid and four parts water. The amounts of each depend upon the cubical contents of the room. One ounce of cyanide with the proper amounts of acid and water will suffice for a hundred cubic feet of space. For larger rooms the amounts increase correspondingly.

After the stock has been packed in the fumigatorium, gas may be generated. Place a glass or earthenware vessel in the center of the room. Pour in first the water, then the acid. The cyanide should be tied in a cloth or paper sack and suspended directly over the vessel by means of a string passing over a spool or pulley at the ceiling, and from there through a small hole in the wall. The object of this is to enable the operator to stand outside and lower the cyanide into the acid solution and thus avoid all danger of inhaling any of the poisonous gas. Gas will form immediately after the chemicals unite and should be allowed to act thirty or forty minutes. At the end of this time the building should be ventilated at least a half hour before being entered.

Parasitical Enemies.—A large percent of scale is destroyed by lady beetles that feed on the insects. Aside from various other insect parasites, a fungus disease is quite active in destroying the insects when weather conditions are favorable. A warm, moist climate is necessary for the disease to do effective work.

BIBLIOGRAPHY

The demand for a popular circular relative to the control of the San Jose scale requires a treatise of the kind in hand rather than a demand for technical works. Consequently no bibliographical references are cited.